

Annexure – III
CSBS – Syllabus

B.Tech. – CSE CSBS						
Sr. No.	Course Code	Course Name	L	T	P	Credits
1	EN3BS06	Discrete Mathematics	3	0	0	3
2	EN3BS07	Introductory topics in statistics, probability and calculus.	3	0	0	3
3	EN3ES09	Fundamentals of Computer Science	3	0	2	4
4	EN3ES11	Principles of Electrical Engineering	3	0	2	4
5	EN3BS10	Physics for Computing Science	3	0	2	4
6	EN3HS05	Business Communication & Value Science – I	2	0	2	3
7		Induction Program (Non Credit)	0	0	0	0
		Total	17	0	8	21
		Total Contact Hours	25			



Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3BS06	Discrete Mathematics	3	0	0	3

UNIT I Abstract algebra: Set, Different types of sets, Operation on sets, Relation, Binary Relation, Equivalence relation, Functions: Partial order relation, Poset, least upper bound, greatest lower bound, maximal and minimal elements of a poset.

UNIT II Boolean algebra: Group, Finite and Infinite group, Ring, Polynomial ring, Field, Subfield, Skew field. Lattices, Distributive laws in lattices – Complemented lattices, Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

UNIT III Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

UNIT IV Graph Theory: Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planar graph, independence number and clique number, chromatic number, statement of Four-color theorem.

UNIT V Logic: Propositional calculus - propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

Text Books:

1. Liu and Mohapatra, Elements of Discrete Mathematics, McGraw Hill
2. Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill
3. M. Morris Mano, Digital Logic & Computer Design, Pearson.
4. N. Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, Englewood Cliffs.

Reference Books:

1. J.P. Tremblay and R. Manohar Discrete Mathematical Structures with Applications to Computer Science, McGraw Hill
2. R. A. Brualdi, Introductory Combinatorics, North-Holland, New York.
3. J. A. Bondy and U. S. R. Murty, Graph Theory with Applications, Macmillan Press, London.
4. L. Zhongwan, Mathematical Logic for Computer Science, World Scientific, Singapore.
5. E. Mendelsohn, Introduction to Mathematical Logic, (Second Edition), Van-Nostrand, London

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3BS07	Introductory topics in statistics, probability and calculus.	3	0	0	3

UNIT I Introduction to Statistics

Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample. Representative sample

UNIT II Descriptive Statistics

Classification and tabulation of univariate data, graphical representation. Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution.

UNIT III Theory of Probability, Expected values and Moments

Concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem. Mathematical expectation and its properties, Moments (including variance) and their properties, interpretation. Moment generating function.

UNIT IV Probability Distribution

Discrete and continuous distributions, Binomial, Poisson and Geometric distributions, Uniform, Exponential, Normal, Chi-square, t , F distributions.

UNIT V Calculus

Basic concepts of Differential and integral calculus, application of double and triple integral.

Text Books :

1. Introduction of Probability Models, S.M. Ross, Academic Press, N.Y.
2. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.

Reference Books :

1. A first course in Probability, S.M. Ross, Prentice Hall.
2. Probability and Statistics for Engineers, (Fourth Edition), I.R. Miller, J.E. Freund and R. Johnson, PHI.
3. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education.
4. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Learning.
5. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg, Pearson Education.
6. Applied Mathematics, Vol. I & II, P. N. Wartikar and J. N. Wartikar, VidyarthiPrakashan.

Web Source:

1. <http://nptel.ac.in/course.php>

Open Learning Source:

1. <https://swayam.gov.in/courses/public>
2. <http://nptel.ac.in/course.php>

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3ES09	Fundamentals of Computer Science	3	0	2	4

UNIT I

Algorithm and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops. Introduction to imperative language; syntax and constructs of a specific language (ANSI C). Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian). Constants, Declarations.

UNIT II

Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, goto labels, structured and un-structured programming.

UNIT III

Functions and Program Structure with discussion on standard library: Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialization, Recursion, Pre-processor, Standard Library Functions and return types.

UNIT IV

Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialization of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated, Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral structures, Table look up, typedef, unions, Bit-fields

UNIT V

Input and Output: Standard I/O, Formatted Output – printf, Formatted Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, stdout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions. Unix system Interface: File Descriptor, Low level I/O – read and write, open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator. Programming Method: Debugging, Macro, User Defined Header, User Defined Library Function, makefile utility.

Text Books:

1. The C Programming Language, (Second Edition) B. W. Kernighan and D. M. Ritchi, PHI.
2. Programming in C, (Second Edition) B. Gottfried, Schaum Outline Series.

Reference Books:

1. C: The Complete Reference, (Fourth Edition), Herbert Schildt, McGraw Hill.
2. Let Us C, Yashavant Kanetkar, BPB Publications.

Practical :-

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
 - i. Small but tricky codes
 - ii. Proper parameter passing
 - iii. Command line Arguments
 - iv. Variable parameter
 - v. Pointer to functions
 - vi. User defined header
 - vii. Make file utility
 - viii. Multi file program and user defined libraries
 - ix. Interesting substring matching / searching programs
 - x. Parsing related assignments

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3ES11	Principles of Electrical Engineering	3	0	2	4

UNIT I

Introduction: Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff's laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

UNIT II

DC Circuits: Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation, Superposition theorem.

UNIT III

AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (Δ - Δ & Δ - Δ).

UNIT IV

Electrostatics and Electro-Mechanics: Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.

UNIT V

Measurements and Sensors: Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power).
Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System & Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.

Indians

For Additional Further Reading Only - Principle of batteries, types, construction and application, Magnetic material and B-H Curve, Basic concept of indicating and integrating instruments

Text Books:

1. Electric Machinery, (Sixth Edition) A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2. A Textbook of Electrical Technology, (vol. I), B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press.
2. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
3. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
4. Engineering Circuit Analysis, William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
5. Fundamentals of Electrical and Electronics Engineering, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.

List of Practicals:

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits
2. To verify KCL and KVL.
3. To verify Maximum power transfer theorem.
4. To verify Thevenin's theorem.
5. To verify Norton's theorem.
6. To verify Superposition theorem.
7. Simulation of time response of series RC circuit.
8. Simulation of R-L-C series circuits for $X_L > X_C$, $X_L < X_C$.
9. Demonstration of measurement of electrical quantities (single-phase power & current) in R-L, R-C & R-L-C circuit.
10. To verify relation in between voltage and current in three-phase balanced star and delta connected load.
11. Determination of resistance temperature coefficient.



Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3BS10	Physics for Computing Science	3	0	2	4

UNIT I

Laser and Fiber optics: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO₂ and Neodymium lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering, Fiber optics and Applications, Types of optical fibers.

UNIT II

Interference-principle of superposition-young's experiment: Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

Polarization of light: Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical and circularly polarized light, Brewster's law, double refraction.

UNIT III

Quantum Mechanics: Introduction - Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box, Heisenberg Picture.

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC and HCP structures.

UNIT IV

Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring mass system. Resonance-definition., damped harmonic oscillator - heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.

UNIT V

Semiconductor Physics: Conductor, Semiconductor and Insulator; Basic concept of Band theory.

Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

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Text Books:

1. Concepts of Modern Physics, (Fifth Edition) A Beiser, McGraw Hill International.
2. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, Wileyplus.

Reference Books:

1. Optics, (Fifth Edition) Ajoy Ghatak, Tata McGraw Hill.
2. Sears & Zemansky University Physics, Addison-Wesley.
3. Fundamentals of Optics, (Third Edition) Jenkins and White, McGraw-Hill.

List of Practical:

1. To study the Hall effect experiment and find the Hall coefficient, carrier density and carrier mobility of a given semiconductor crystal.
2. To determine the radius of curvature of Plano convex lens using Newton's ring experiment.
3. To measure the Beam divergence and Beam waist of a Laser beam.
4. To determine wavelength of spectral lines of mercury vapor lamp with the help of grating and spectrometer.
5. To measure the numerical aperture of an optical fiber by scanning Method.
6. Determination of Planck's constant (h) using light emitting diode (LED) of various colours.
7. To determine the heating efficiency of an electric kettle with varying voltages.
8. To determine the specific optical rotation of sugar solution by biquartz Polarimeter.
9. To determine the value of acceleration due to gravity (g) using compound pendulum.
10. To determine the Standard deviation of any one of the following, by algebraic formula
 - i. Thickness of the given scale by Vernier calipers
 - ii Diameter of the wire by Screwgauge.
11. Mini Project(compulsory).



Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3HS05	Business Communication & Value Science – I	2	0	2	3

UNIT I

Overview of LOL (include activity on introducing self)

Self-work with immersion – interview a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them

Overview of business communication

Self-awareness – identity, body awareness, stress management

UNIT II

Essential Grammar – I: Refresher on Parts of Speech – Listen to an audio clip and note down the different parts of speech followed by discussion

Tenses: Applications of tenses in Functional Grammar – Take a quiz and then discuss **Sentence formation** (general & Technical), Common errors, Voices. Show sequence from film where a character uses wrong sentence structure (e.g. Zindagi Na Milegi Dobara where the characters use 'the' before every word)

UNIT III

Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, significant abbreviations formal business vocabulary – Read Economic Times, Reader's Digest, National Geographic and take part in a GD, using the words you learnt/liked from the articles.

Group discussion using words learnt

UNIT IV

Email writing: Formal and informal emails, activity

Verbal communication: Pronunciation, clarity of speech **Communication Skills:** Overview of Communication Skills

Barriers of communication, Effective communication

Types of communication- verbal and non – verbal – Role-play based learning

Importance of Questioning Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening.

Expressing self, connecting with emotions, visualizing and experiencing purpose

Written Communication: Summary writing, story writing

Build your CV – start writing your comprehensive CV including every achievement in your life, no format, no page limit

Life skill: Stress management, working with rhythm and balance, teamwork

UNIT V

Understanding Life Skills: Movie based learning – **Pursuit of Happiness.** What are the skills and values you can identify, what can you relate to?

Introduction to life skills

What are the critical life skills **Multiple Intelligences**

Embracing diversity – Activity on appreciation of diversity

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Life skill: Join a trek – Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation

Text Books:

There are no prescribed texts for Semester I – there will be handouts and reference links shared.

Reference books:

1. English vocabulary in use – Alan Mc'Carthy and O'dell
2. APAART: Speak Well 1 (English language and communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Business Communication – Dr. Saroj Hiremath

Web References:

1. Train your mind to perform under pressure- Simon sinek
<https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-underpressure-capture-your-flag/>
2. Brilliant way one CEO rallied his team in the middle of layoffs
<https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-beforenumbers.html>
3. Will Smith's Top Ten rules for success
<https://www.youtube.com/watch?v=bBsT9omTehQ>

Online Resources:

1. <https://www.coursera.org/learn/learning-how-to-learn>
2. <https://www.coursera.org/specializations/effective-business-communication>

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Soft Skills Scheme

Sr. No.	Course Code	Course Name	L	T	P	Credit	Semester
1	EN3MC06	Introduction to progressive soft skills and aptitude	2	0	0	0	5 th Semester
2	EN3MC08	Fundamentals of soft skills and aptitude	2	0	0	0	3 rd Semester

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Course Code	Course Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
EN3MC06	Introduction to progressive soft skills and aptitude	2	0	0	2	0

UNIT I

Introducing your friend: This session involves icebreaker activities to orient the students for the entire program. The activity is to try using as many adjectives as possible to describe one's friend. Students are encouraged to speak about their friends on the stage. Also, students will learn and practice introducing them (Self introduction) as self-introduction is usually the first question in any personal interview. Also, the appropriate way to introduce oneself is taught.

Who gets the heart? To improve reasoning, convincing and speaking skills of students. Student groups are provided with specific case of an individual in requirement of a heart along with the profile of the person. Student will advocate why the person they represent deserves to get the heart over others. This imparts the needed convincing skills for group discussions and personal interview where students need to convincingly put forth their opinion and views.

Debate: The objective of the session is to strengthen students' skills in the areas of leadership, interpersonal characteristics, influence over others, problem analysis, solution and presentation. Students are given topics and are made to debate on it. Cross-questioning is encouraged.

UNIT II

Sentence correction: Subject-Verb Agreement, Modifiers, Parallelism

Vocabulary: Vocabulary Demystified, Synonyms and Antonyms, Word Analogy, Miscellaneous Vocabulary

UNIT III

Sentence completion and Para- jumbles: Pro-active thinking, Reactive thinking (signpost words, root words, prefix suffix, sentence structure clues), Fixed jumbles, Anchored jumbles

Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalency, Division of wages

UNIT IV

Data arrangements and blood relations: Linear Arrangement, Circular Arrangement, Multi-dimensional Arrangement, Blood Relations.

Reading comprehension: Speed Reading Strategies, RC - Types and Tackling Strategies.

UNIT V

Story Mason: To make the students participate in group interactions, create dialogue and present on stage as a group. This activity allows introverts or students with stage fear to present a narration along with the group mates on the stage. This slowly helps those students to come out of their inhibition to speak in-front-of an audience.

Ratio and Proportion: Ratio, Proportion, Variation, Simple equations, Problems on Ages.

Articles, Prepositions and Interrogatives: Definite and Indefinite Articles, Omission of Articles, Prepositions, Compound Prepositions and Prepositional Phrases, Interrogative

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Course Code	Course Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
EN3MC08	Fundamentals of soft skills and aptitude	2	0	0	2	0

UNIT I

Body Language and professionalism: To make participants aware of the importance of Body language trains them to project a better outlook of themselves. This helps in presenting themselves in Personal interview and Group discussions. Grooming and presenting oneself are the main focus. Interview dress code, facial expressions, body language, hand shake etiquettes etc., are dealt in the session. Worksheets, anecdotes, videos and role-plays are some of the important components of the session.

Interpersonal skills: Effective interpersonal skills are crucial to increase employment opportunities and to compete in the business environment. This session makes the participants understand different barriers to proper interpersonal communication and to tackle them head-on. Activities are an integral component of the session.

Reporter: The aim of the session is to make every student ask rational questions and make diplomatic replies. The session is a press-meet like group activity session.

UNIT II

Team Building: To make every student intermingle within a team and contribute to the team's success. To make them understand the importance of working as a team. Importance of complimentary skill sets, and synergy effects of a team are proved using real-life examples and classroom activities.

Picture connector: To make the students participate in group interactions, create dialogue and present on the stage. Students link various pictures from newspaper to come up with a pictorial representation of a story or idea and narrate/present the same. Creativity and presentation skills are concentrated. Students also learn to connect various variables and come up with concrete ideas.

UNIT III

Time and work: Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages

Goal Setting: • To make students goal oriented and to help them realise and sketch their personal and professional goals. SMART goal technique for goal setting is taught and explained using examples. Students will be encouraged to set a personal and career goal based on the SMART technique. Tactics to deal with hurdles for attaining the goals are dealt. Famous goal setting success stories are shared to boost confidence.

UNIT IV

Time Management: To make students understand the value of time and effective management of their time. Paper tower activity helps students practically experience the importance of managing time and to improve at it. Time management grid helps students understand the importance of prioritizing.

Tourism pitch: The session makes students present and promotes their choice of tourist spot or their favourite city in order to convince the client (trainer) to visit the city. Presentation skills are enhanced. Teamwork is practised during the preparation phase of the activity.

UNIT V

Shopping role play: To enable students to frame dialogues for their day-to-day life scenarios. A shopping scenario has to be mimicked by the students with impromptu conversation. This helps them in practising speaking in English in their daily conversations. Sample everyday conversations are presented for practical learning.

Shipwreck: The main objective of this is to enhance the skill capacity of the students to think out of the box and try to enhance the cognitive thinking capability.

Play teacher: The session makes students understand the different values and virtues like empathy- by which they will try to enact the scenario given to them try solving the problem like an adviser.

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Ph.D Syllabus

Course Code	Course Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
EN6CE02	Advance Concrete Technology	4	0	0	4	4

UNIT I

Cement & its properties, Structure of Hydrated Cement paste, volume of hydrated product Rheology of Concrete, Properties of fresh concrete, Compaction of concrete, Curing of concrete, Maturity of concrete.

UNIT II

Chemical Admixtures:- Mechanism of chemical admixture, plasticizers & super Plasticizers, their effect on concrete property in fresh & hardened state, retarder, accelerator.

Mineral Admixtures:- Fly Ash, Silica fume, GCBS, and their effect on concrete property in fresh state and hardened state.

UNIT III

Properties of hardened concrete, strength characteristic, shrinkage, creep, permeability & durability of concrete, chemical attack, acid attack, efflorescence, IS 456-2000 requirement for durability.

UNIT IV

Concrete at low & high temp., Under water concreting, shotcrete, air entrained concrete, self compacting concrete, high performance concrete, high Volume fly Ash concrete concept.

UNIT V

Mix design-factors affecting mix design, design of concrete mix by BIS method using IS 10262, Provisions in revised IS 10262-2004, Non destructive testing of concrete.

Text Books:

1. M.L. Gambir, Concrete Technology, Tata Mc. Graw Hill Book Co.
2. P. kumar Mehta & Paulo J.M., Monteiro, CONCRETE, Mc. Graw Hill Education (India) Pvt. Ltd.
3. A.M. Neville & J.J. Brooks, Concrete Technology, Pearson.

Reference Books :

1. N. Krishna Raju, Concrete mix design, Sehgal Publication.
2. IS 10262-2004
3. M.S. Shetty, Concrete Technology, S. Chand.



Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN6EC05	Machine Learning	4	0	0	4

UNIT I : Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance, Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares.

UNIT II: Linear Classification, Logistic Regression, Linear Discriminant Analysis, Perceptron, SVM, Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation

UNIT III : Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures, Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting, Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks

UNIT IV Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering

UNIT V Semi-supervised Learning, Reinforcement Learning: Deep Learning, CNN, RNN architectures, Training RNN- Loss and BPTT, LSTM, Deep RNN and Bi-RNN.

Text Books:

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
2. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)
3. Introduction to Machine Learning by Ethem Alpaydin, the MIT Press

Reference Books:

1. Introduction to Machine Learning by Alex Smola and S.V.N Vishwanathan Cambridge University Press
2. Machine Learning by Tom Mitchell McGraw Hill

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN6EC03	Internet of Things and its Applications	4	0	0	4

UNIT I

Introduction: Definition & Characteristics of IoT, Physical and Logical Design of IoT, IoT Applications, IoT Challenges.

UNIT II

IoT Networking: IoT Communication Protocols: COAP, MQTT, AMQP, IoT Semantic Protocol: JSON, Machine-to-Machine Communication, SDN.

UNIT III

Introduction to Python Programming: Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages.

UNIT IV

IoT Physical Devices & Endpoints: Raspberry Pi device, Raspberry Pi Interfaces, Programming Raspberry Pi with Python: LED, Switch, LDR Interface & Control, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT V

IoT Analytics & Case Study:

Cloud Computing, Fog Computing, Case Study: Smart Cities, Smart Homes, Connected Vehicles, Industrial IoT, Health Care and Smart Agriculture.

Text Book:

1. V. Madiseti and A. Bahga, "Internet of things (A-Hand-on-Approach)", Universal Press.
2. Rajkamal, "Internet of Things", Tata McGraw Hill publication.
3. A. Pajankar and A. Kakkar, "Raspberry Pi by Example", Packt Publishing Ltd, Birmingham, UK.

Reference Book:

1. F. Dacosta "Rethinking the Internet of things: A Scalable Approach to Connecting Everything", Apress publications.
2. D. Norris, "The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and BeagleBone Black", McGraw-Hill Education, New Delhi.
3. P. Raj and A.C. Raman, "The Internet of Things", CRC Press (T&F Group), New York.

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Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN6EC04	Advanced Nonlinear Systems	4	0	0	4

UNIT I Analysis of nonlinear dynamics. Describing functions and phase plane analysis. Nonlinear systems and equilibrium points, Concepts of stability, Linearization and local stability, Lyapunov's direct method, Popov and Circle criterion, Center manifold Theorem, Invariant set theorems, Lyapunov analysis of LTI systems,

UNIT II Control design based on Liapunov's direct method, Feedback Linearization and the canonical form, Lie derivative, Lie Bracket Input-state Linearization of SISO systems, Input-output Linearization of SISO systems, Broket Theorem, Sliding Mode Control, Back stepping design.

UNIT III Unstructured, structured and parametric uncertainties. Direct and indirect adaptive control schemes. The principle of certainty-equivalence. Adaptive laws, Model reference adaptive control, Robustness in adaptive control, Adaptive control of nonlinear systems, Gain scheduling control.

UNIT IV Least square estimation, updating the parameter estimates for linear regression models, The recursive least square method, Model-reference Adaptive Systems. The Gradient Approach, MRAS Based on Stability Theory, Direct MRAS for General Linear Systems, MRAS for Partially Known Systems.

UNIT V Self-tuning Regulators, The Basic Idea, Indirect Self-tuning Regulators, Direct Self-tuning Regulators, Unification of Direct Self-tuning Regulators, Linear Quadratic STRs, Adaptive Predictive Control.

Text Books

1. H.K. Khalil, Nonlinear Systems, Prentice hall.
2. Shankar Sastry, Nonlinear Systems; Analysis, Stability and Control, Springer.
3. Astrom, K.J. and Wittenmark, B., "Adaptive Control", Pearson Education.

Reference Books:

1. Mathukumalli Vidyasagar, Nonlinear systems analysis, SIAM.
2. Alberto Isidori, Nonlinear Control Systems -Volume 1, Springer.
3. Alberto Isidori, Nonlinear Control Systems -Volume 2, Springer.

Shilpa

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN6ME07	Advanced Manufacturing Technology	4	0	0	4

UNIT I

Introduction: Need and comparison between traditional, nontraditional machining process, Classification of advanced machining process, Hybrid Process, High speed machining, Cryogenic machining, Concept of Machinability and its Improvement.

UNIT II

Non conventional processes: Mechanism of material removal for Ultrasonic machining, water jet machining, electric discharge machining, electrochemical machining, plasma arc machining effect of process parameters and variables, applications and limitations.

UNIT III

Micromachining Processes: Introduction, Diamond turn machining, Application and technique of Micro milling, abrasive jet micromachining, magnetorheological nanofinishing process, Electron beam Micromachining, Magnetic Float Polishing for ceramic balls.

UNIT IV

Computer integrated manufacturing Systems, Automation of manufacturing process, Computer Numeric Control, Adaptive control, Group technology, Cellular manufacturing, Flexible Manufacturing system, Just-in Time Production, Lean manufacturing, and Artificial Intelligence.

UNIT V

Rapid Prototyping: Stereo-lithography, Fused-deposition modeling, Selective laser sintering, Laminated-object manufacturing, 3D printing, subtractive v/s additive manufacturing process LIGA Process, Rapid Tooling, Jigs and Fixtures for Machine shops.

Text Books:

1. D.G. Boothroy and W.A Knight. "Fundamentals of Machining and Machine tools", Marcel Dekker, New York.
2. M.P.Groover "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", John Wiley and Sons.
3. V.K. Jain "Advanced Machining Process", Allied Publishing Pvt. Ltd.

Reference Books :

1. S Kalpakjian and S. Schmid, "Manufacturing Processes for Engineering Materials", Pearson.
2. V.K.Jain, "Introduction to Micromachining", Narosa Publishing House.
3. Amitabha Ghosh, Ashok Kumar Mallik, "Manufacturing science", East-West Press Pvt. Ltd.
4. Yi Qin "Micro-Manufacturing Engineering and Technology", Elsevier Publication.
5. P.C.Pandey "Modern Machining Processes", Tata McGraw Hill, New Delhi.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN6EE03	Application of Reliability Engineering to Power System	4	0	0	4

UNIT I

Introduction to reliability and indices, methods of reliability improvement, failure density function, reliability function, hazard function, MTTF, exponential failure density function, effect of wear in period on reliability.

UNIT II

Reliability evaluation of series, parallel, and series-parallel network. Complex network reliability evaluation using event space, decomposition, tie-set, cut-set method.

UNIT III

Repair density function, state diagram, availability and unavailability function. Evaluation of steady-state probability concept of frequency and durations, state enumeration method for evaluating failure frequency, MUT, MDT, frequency balance approach.

UNIT IV

Generating System Reliability Evaluation: Generation model, load models, risk model, evaluation of LOLP, LOLE, EENS, EDNS, effect of maintenance, transmission systems reliability evaluation.

UNIT V

Distribution System Reliability Evaluation: Evaluation of basic reliability indices i.e. system failure rate, average outage time, annual outage time, customer oriented indices i.e. SAIFI, SAIDI, AENS, CAIDI, evaluation of indices for parallel and radial distribution system.

Text books:

1. Roy Billinton and Ronald Allan, "Reliability Evaluation of Power Systems", SIE.
2. C.E. Ebeling, "Reliability and maintainability engineering", TMH.
3. E.E. Lewis, "Introduction to reliability engineering", John Wiley and Sons

Reference Books:

1. David J. Smith, "Reliability maintainability and risk", Elsevier.
2. Joel A. Nochlas, "Reliability Engineering: Probability Models and maintenance methods", Taylor and Francis.

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